

THEEWATERSKLOOF MUNICIPALITY

LANDFILL CLOSURE PROVISIONS



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AAN H. MARINIUS OP 12/07/2016.



JUNE 2016



JPCE

THEEWATERSKLOOF MUNICIPALITY



Theewaterskloof
Municipality

LANDFILL CLOSURE PROVISIONS

Compiled by:



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JUNE 2016

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THEEWATERSKLOOF MUNICIPALITY

LANDFILL CLOSURE PROVISIONS

1. INTRODUCTION

The purpose of this report is to determine the rehabilitation costs for the waste disposal sites in the Theewaterskloof Municipal area. The sites under consideration are the Caledon, Genadendal, Greyton, Riviersonderend and Villiersdorp disposal sites.

These sites are permitted/licensed as follows:

Caledon:	Permitted for operation on 30 January 1997 in terms of the Environment Conservation Act, 1989 (ECA 1989). Latest amendment on 5 July 2005.
Genadendal:	Licensed for closure on 7 November 2014 in terms of the National Environmental Management: Waste Act, 2008 (NEMWA 2008).
Greyton:	Licensed for closure on 7 November 2014 in terms of NEMWA 2008.
Riviersonderend:	Licensed for closure on 11 December 2014 in terms of NEMWA 2008.
Villiersdorp:	Permitted for operation on 30 November 1999 in terms of ECA 1989. Amended to operate a transfer station on 20 December 2004.

The closure of a landfill site, regardless if it is licensed/permitted or not, requires a closure licence as well as rehabilitation. The Minimum Requirements states that "In order to close a landfill properly, however, closure must be preceded by rehabilitation, to ensure that the site is environmentally acceptable." For the purposes of this report, due to the fact that the same requirements are set for licensed/permitted and unlicensed/unpermitted sites process to be followed, no distinction in the descriptions of the process were made between licensed/permitted and unlicensed/unpermitted sites. Therefore "closure" describes the process and "rehabilitation" is part of this process.

The actual cost estimates are determined by calculating the volumes of excavations, materials required and legal requirements according to the footprint of each individual site. For a new estimate the rates used for each item of work is based on current rates for similar activities. If a previous estimate was done for a specific site then the previous year's figures are escalated using an approximate Consumer Price Index value. The individual rates are then again cross-checked to determine if they are still in line with current rates for similar activities and adjusted accordingly. Due to the nature of the various construction items which are used to determine the cost estimates, the above method is required. For example, to excavate a trench, the required process is described in SANS 1200. We compare recent rates for this item, which would include labour costs as priced by civil contractors and we can use a good average to use in the calculations. An average must be used, because not one contractor will ask the same price to excavate per meter as the next contractor. This is done for all similar items which are priced in this manner. Items which include material costs such as Geosynthetic Clay Liners (GCL's) and/or geosynthetic products, are very much dependent on exchange and import rates on top of the material cost as some of these are not necessarily manufactured in South Africa. The combined effect of these various items and escalation in prices will result in the current year's estimate for landfill closure provision not always being exactly in line with CPI, but should be in a similar range. The percentage increase will also differ for each individual landfill site as some landfills will require more material to be imported as per the specific site requirements as well as varying rehabilitation areas.

The Caledon landfill's classification is G:C:B+ where the "G" classification refers to the type of waste that may be received at the site, which in this case is "general waste". General waste is the description given to all domestic waste and all wastes generated from commercial, business and industrial activities that are not hazardous or toxic. Pharmaceutical and medical wastes are also not part of general waste. The "C" classification refers to a volume of waste disposed of less than 25 tonnes per day and the "B+" indicates that the site is likely to generate significant leachate on account of the climate. This climatic water balance is calculated in accordance to the Minimum Requirements (2nd Edition, 1998) Clause 3.4.2. Leachate management systems are required for B+ sites according to Minimum Requirements.

The Genadendal and Greyton landfills are classified as G:C:B- where the "B-" indicates that the sites should not generate significant leachate due to the climate.

The Riviersonderend landfill is classified G:S:B- and the Villiersdorp landfill G:S:B+ where the "S" indicates a volume of waste disposed of between 25 and 150 tonnes per day.

In terms of Clause 8.4.7 of the Minimum Requirements Second Edition the capping should work in conjunction with the base liner in limiting long-term leachate generation. As a result the above classifications are not necessarily indicative of the capping design specified in the issued licenses. None of these sites were constructed with impermeable base liners or leachate management systems and as a result the Minimum Requirements in terms of the capping layers were only taken as the departure point for the layerworks design and then additional layers were added in order to have a capping design that prevents the infiltration of water that could generate leachate.

The rehabilitation estimates in this report have therefore been based on the requirements for capping layers, amongst others, stipulated in the issued licences to which the licence holder (Theewaterskloof Municipality) must comply. The capping requirements are detailed in **Section 3** of this report.

2. GENERAL LOCATION AND SIZE

The footprints were measured using Google Earth in conjunction with Model Maker and are based on the co-ordinates stipulated in some of the licenses and the topographical survey that was available for Caledon. Model Maker software is a digital design package used for various civil engineering designs. In this case, Model Maker is used to measure the footprint and perimeter of the sites. A digital model is also built to measure the surface area of the final waste body for quantity calculations.

2.1 CALEDON

58 300m²



Figure 2-1: Caledon Disposal Site

2.2 GENADENDAL

15 240m²



Figure 2-2: Genadendal disposal site

2.3 GREYTON

16 000m²



Figure 2-3: Greyton Disposal Site

2.4 RIVIERSONDEREND

10 720m²



Figure 2-4: Riviersonderend Disposal Site

2.5 VILLIERSDORP

21 110m²



Figure 2-5: Villiersdorp Disposal Site

3. CLOSURE AND REHABILITATION

3.1 CAPPING DESIGN

The capping designs for the sites under consideration on which the cost estimates are based, are detailed below as required by the issued licences.

3.1.1 Licence requirements (Genadendal, Greyton, Riviersonderend)

In the issued licenses the following is specifically stated regarding rehabilitation (Genadendal, Greyton):

"The Facility must be capped with an appropriate infiltration control cap comprising of approximately 200mm topsoil on top of approximately 450mm of compacted clay (in 3 type V layers of the Minimum Requirements of 1998) having a clay permeability not exceeding 10^{-6} cm/sec or have static infiltration less than 0.5m/year, over a compacted waste body shaped to have a slope between 1v:4h (25%) and 1v:50h (2%). An alternative to the approximately 450mm Compacted Clay Layer ("CCL") of specified performance clay is acceptable in which the 450mm CCL is replaced with approximately 450mm random soil compacted fill over a Geosynthetic Clay Layer."

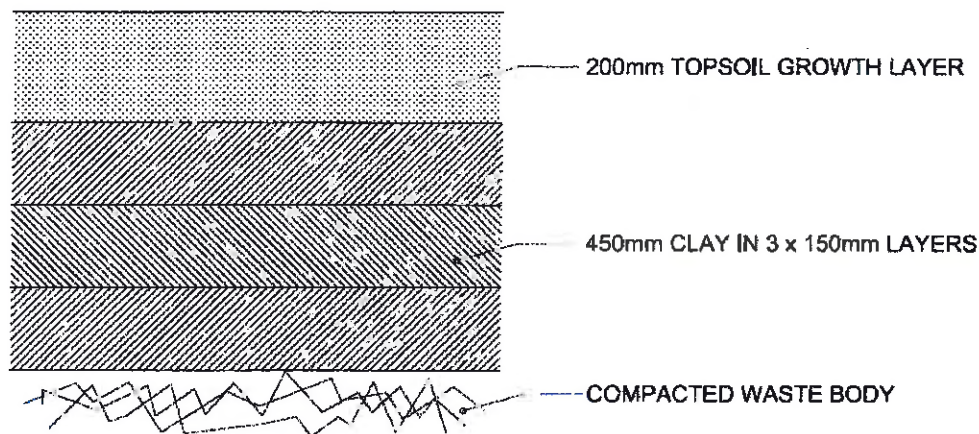


Figure 3.1: Capping Design described Greyton and Genadendal Licences

The closure licence for the Riviersonderend landfill specifically states the following:

"The Facility must be capped with an appropriate infiltration exclusion cap comprising out of 200mm topsoil, 450mm of load generating soil (whose materials will define whether under drainage is required or not), a composite liner (of 1.5mm HDPE geomembrane plus 300mm liner of compacted clay (in 2 type V layers of the Minimum Requirements of 1998) having a clay permeability not exceeding 10^{-6} cm/sec or have static infiltration less than 0.5m/year, over a compacted waste body shaped to have a slope between 1v:4h (25%) and 1v:50h (2%). An acceptable alternative to the 300mm Compacted Clay Layer ("CCL") of specified performance clay is a Geosynthetic Clay Layer."

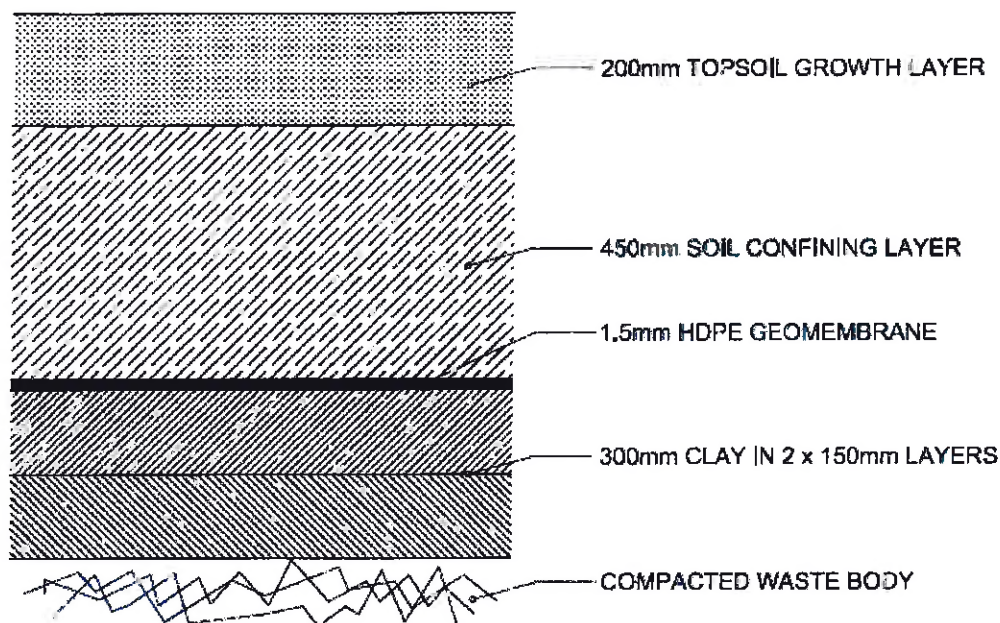


Figure 3.2: Capping Design described Riviersonderend Licence

The CCL above refers to "Compacted Clay Liner" and the GCL to "Geosynthetic Clay Liner". The option to use GCL with a confining soil layer instead of the CCL was opted for in the current estimates as it is unlikely for these sites to have on-site clay of sufficient quantity and quality to construct the CCL. Additionally to the above layerworks, the use of a GCL requires a levelling layer to ensure the long-term integrity of the GCL (HDPE for Riviersonderend) by not being in direct contact with waste material. HDPE cusped sheets were added on top of the GCL to ensure efficient drainage of the overlying material to prevent pore pressure build-up that could cause slip/failure of the overlying material and also prevent build-up of a hydraulic head on the GCL (HDPE for Riviersonderend) which in turn reduces possible infiltration into the waste body.

The same capping design for Genadendal and Greyton was assumed for the Caledon and Villiersdorp disposal sites as these two sites still require closure licences. For the current year of assessment, the capping layers as described in this section will most likely be stipulated as a requirement should closure licences be issued now. The additional layer of 1.5mm HDPE geomembrane for Riviersonderend was stipulated in the licence due to the site's close proximity to the river. Provision was also made in the Riviersonderend estimate to install a Geogrid on the external slopes to ensure stability of the layers on top of the 1.5mm HDPE geomembrane.

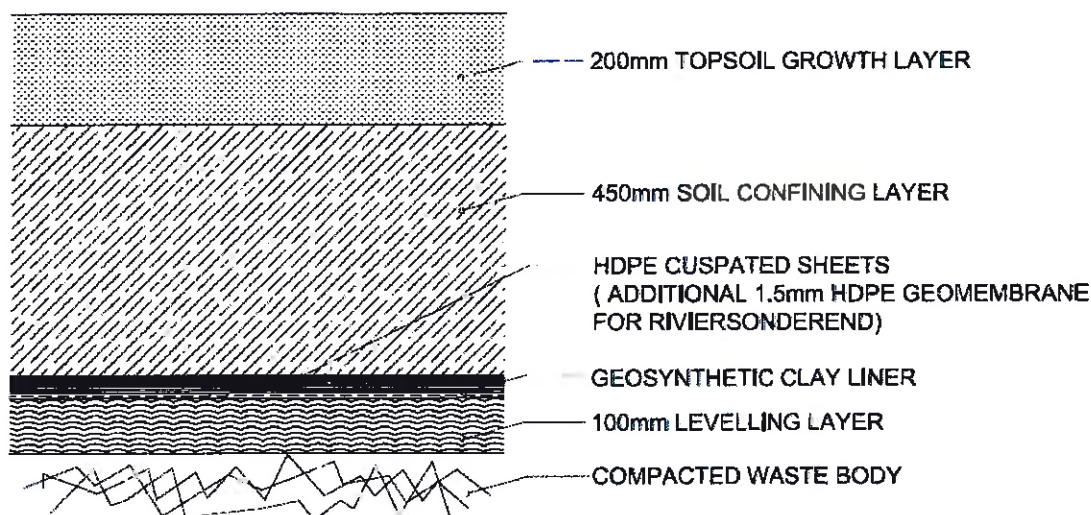


Figure 3.4: New Capping Design for Estimates

The rates for the topsoil, confining layer and levelling layer were based on the requirement to import these materials from commercial sources due to their unavailability from on-site and/or nearby sources.

3.2 STORMWATER CONTROL

The closure cost estimate makes provision for concrete Hyson cell-lined storm water channels around the toe of the landfills as well as on top of the landfills. The use of Hyson cells will provide sufficient flexibility in the event of differential settlement and the concrete infill will provide sufficient erosion protection for the higher flow velocities on the slopes.

In accordance with the Minimum Requirements of the Department of Water Affairs (2nd Edition-1998) these storm water channels have to be designed for a 1 in 50 year storm with a 24 hour duration. The closure licenses require the same.

3.3 LEACHATE CONTROL

The closure licences require the following:

"Sporadic leachate from the Facility must be managed by means of works which must be constructed and maintained on a continuous basis by the License Holder and be lined as approved by the Responsible Authority, to prevent pollution to groundwater."

- (a) *With written approval of the Licensing Authority be evaporated in lined dams as approved by the Licensing Authority; and*
- (b) *Be discharged into any convenient sewer if accepted by the authority responsible for that sewer."*

Provision was made in the estimates to install a leachate collection tank along with a drainage system consisting of a stone-filled trench containing a geo-pipe along the toe of the waste body to drain into the tank if any leachate seeps from the waste body.

Provision was also made to install water monitoring boreholes at the facilities where these do not exist.

3.4 REMAINING SITE LIFETIMES

Caledon

According to the latest topographical survey the Caledon landfill has reached its capacity as proposed in the Operating Plan. Operations need to continue until a suitable alternative has been established, e.g. a transfer station replacing the landfill in order to dispose elsewhere. The estimated duration is one to two years.

Genadendal, Greyton, Riviersonderend

These sites have been issued with closure licenses. The Greyton licence states that operation will continue for another five years from the licence issue date and all three licences state that the decommissioning phase must commence within a period of five years.

Villiersdorp


The Villiersdorp landfill does not receive waste any longer. There is a transfer station adjacent to the landfill from where Villiersdorp's waste is transported for disposal elsewhere.

4. SUMMARY OF ASSUMPTIONS

- It is assumed that the footprints that require rehabilitation as described and indicated above is correct and will be verified by the relevant local authority.
- The rate for capping layers are based on import requirement from commercial sources.
- Insufficient quality and quantity clay available, requiring the use of GCL's.

Report compiled by:


W Meyers B. Eng


W Visser Pr. Tech. Eng.

ANNEXURE 1

SUMMARY BILLS OF QUANTITIES

Date: 30-06-2016

Site Name:	Caledon	Genadendal	Greyton	Riviersonderend	Villiersdorp
Rehabilitation Area (m²)	58 300	15 240	16 000	10 720	21 110
Costs for Rehabilitation and Closure:					
Preliminary and General					
Site Clearance and Preparation	2 446 617.74	739 097.36	767 628.23	736 237.62	986 240.96
Storm Water Control Measures	142 359.27	37 213.64	39 069.44	26 176.52	51 547.24
Capping	1 746 295.53	624 986.41	765 482.86	889 257.74	1 095 333.41
Gas Management	13 762 359.04	3 626 718.72	3 803 769.60	3 597 684.75	4 836 456.64
Leachate Management	0.00	0.00	0.00	25 000.00	0.00
Fencing	497 617.17	317 688.11	302 776.86	246 611.16	352 481.02
Other:	1 327 210.00	672 660.00	571 960.00	474 110.00	708 760.00
Environmental Authorisation (Closure Licence)					
Technical ROD	388 808.00	0.00	0.00	0.00	388 808.00
Install Groundwater Monitoring Boreholes with lockable caps (includes drilling contractor site establishment)	79 500.00	79 500.00	79 500.00	79 500.00	79 500.00
Landscape Architects	0.00	139 784.00	123 227.00	143 869.00	171 546.00
Water use license	94 320.00	94 320.00	94 320.00	94 320.00	94 320.00
	0.00	15 720.00	15 720.00	15 720.00	15 720.00
Contingencies					
Engineering: Professional Fees	1 992 245.88	601 836.42	625 068.70	599 507.78	803 081.93
Site Supervision (Engineer's Representative)	1 643 602.85	496 515.05	515 681.68	494 593.92	662 542.59
Site Supervision (Environmental Control Officer & OHS agent)	879 330.00	484 475.33	486 282.33	421 374.25	511 483.00
	90 414.00	55 926.00	57 135.00	53 715.75	51 765.00
Total (Excl. VAT)	R 25 090 679.48	R 7 986 441.06	R 8 247 621.70	R 7 897 678.50	R 10 809 585.80
Cost per rehab (m²)	R 430.37	R 524.04	R 515.48	R 736.72	R 512.06
Estimated construction period (weeks)	24	13	13	11	14

ANNEXURE 2

QUALIFICATIONS

1 June 2016

TO WHOM IT MAY CONCERN

This letter serves to confirm that the firm

JPCE (Pty) Ltd

(Membership No 729)

is a Member of Consulting Engineers South Africa.

THIS CERTIFICATE IS VALID UNTIL 28 FEBRUARY 2017



GILLIAN WANDS
ADMINISTRATIVE OFFICER

I certify that this is a true and correct copy of the original document which has been presented to me.
I certify that according to my observations no alterations have been made to either the original document nor the copy.

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Commissioner of Oaths (RSA)
Johannes Petrus Du Toit CA (SA)
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Waste Management
of Southern Africa**

Institute of Waste Management of Southern Africa

Established to promote the science and practice of waste management.
A professional association for the waste management sector

CERTIFICATE OF MEMBERSHIP PRESENTED TO

JPCE (Pty) Ltd

as an

Organisation Member

Membership Number: 33314001


President



Valid until 30 June 2016

For validity of membership please consult www.iwmsa.co.za

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Die Universiteit van Stellenbosch

Diermee word verklaar dat nademaal

JAN GERHARDUS PALM

ten opsigte van die Magistersgraadkursus in die Ingenieurswese met

SIVIELE INGENIEURSWESE

as studierigting, voldoen het aan al die vereistes soos neergelê in Wet Nr. 37 van 1959 en die Statuut en Regulasies van die Universiteit, die graad

Magister in die Ingenieurswese (M.Ing.)

met al die regte en voorregte daaraan verbonde, by geleentheid van 'n Kongregasie van die Universiteit op
aan hom verleen is.

12 DESEMBER 1984

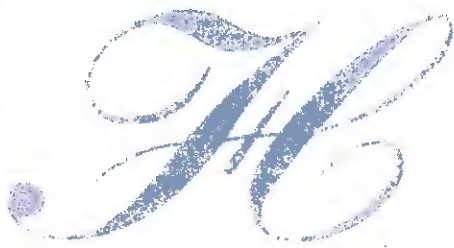

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20

Date 06/12/07 Signature *Minnie*



Nasionale National
Diploma

INGENIEURSWESE: SIVIEL
ENGINEERING: CIVIL

aanvaard

aanvaard

**JOHANNES LODEWIKUS
VISSER**

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1971-05-03

1971-05-03

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(Act No. 46 of 2000)

Date

6 December 2012

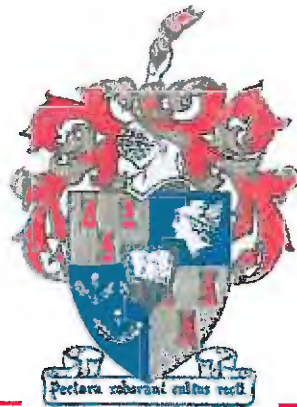
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President

Chief Executive Officer





UNIVERSITEIT VAN STELLENBOSCH

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die vierjarige graad*

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(BIng)

(Siviel)

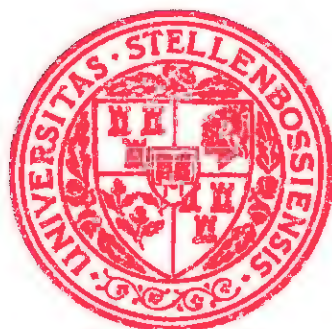
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Chris Brink

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ENGINEERING : CIVIL

awarded to

JOHANNES HENDRIK, GENIS

student number

199002932

with effect from

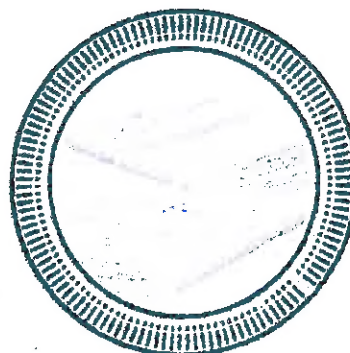
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Registrar

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Vice-Chancellor



39 207

ANNEXURE 3

INDEPENDENCE LETTER



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Fax: 021 981 0868
e-Mail: info@jpce.co.za

Reference: A189\Theewaterskloof

Enquiries: William Meyers

30 June 2016

To Whom It May Concern

CONFIRMATION OF INDEPENDENCE

We hereby confirm that we are completely independent of the Theewaterskloof Municipality.

Our only contact and/or relationship with any official of the Theewaterskloof Municipality is purely professional and based on projects which were awarded to us.

Regards

JPCE (Pty) Ltd

Y:\Projdata\A189\Theewaterskloof2016\Independence letter.docx\jm

**JPCE (Pty) Ltd**

PROJECT MANAGEMENT

• Specialist Consulting Engineers

Page 1

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CLIENT:

THEEWATERSKLOOF MUNICIPALITY

PROJECT:

LANDFILL CLOSURE PROVISIONS

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